

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in this application:

1. (Currently Amended) A process for validating a state of a storage area network (SAN), comprising the steps of:

defining a SAN access path policy representative of SAN logical access paths, said SAN logical access paths defining end-to-end access relationships between an application on a server, a sequence of one or more switches and physical links in the SAN, and data LUNs stored on storage devices in the SAN and having for the logical access paths an associated set of logical access path attributes consisting of at least one of a number of hops within a valid logical access path, a level of end-to-end redundancy for a valid logical access path, and a number of allocated ports for a valid logical access path, wherein the SAN access path policy includes a list of valid access paths and an associated set of access path attributes for the valid access paths,

collecting configuration information from devices of the SAN, standardizing formats of the configuration information and reconciling conflicts,

processing the collected configuration information to identify the SAN logical access paths, and computing the associated access path attribute values, and

defining a state of the SAN based on SAN logical access path attribute values associated with the SAN logical access paths, the attribute values consisting of at least one of a number of hops within a valid logical access path, a level of end-to-end redundancy for a valid logical access path, and a number of allocated ports for a valid logical access path, and

comparing the identified SAN logical access paths and computed access path attribute values with the list of valid access paths and associated set of access path attributes for the valid access paths in the SAN access path policy to identify any logical access path discrepancies or violations, thereby validating the state of the SAN.

2. (Currently Amended) The process of claim 1, and further including identifying a logical access path violation if at least one identified SAN logical access path is in disagreement with the

list of valid access paths and associated set of access path attributes for the valid access paths in the SAN access path policy.

3. (Original) The process of claim 1, and further including defining a SAN notification policy for notifying a user about SAN logical access path violations.

4. (Original) The process of claim 3, wherein notifying a user includes sending a message to the user with violation information, said message selected from the group consisting of email, graphic text and SNMP messages.

5. (Currently Amended) The process of claim 1, and further including identifying partial logical access paths, and comparing logical access path attribute values of the partial paths with the SAN logical access path policy.

6. (Original) The process of claim 1, wherein said configuration information includes device properties selected from the group consisting of server ID, server port configuration, switch port configuration, switch ID, switch IP and domain ID, grouping of devices, zoning of devices, storage device ID, LUNs of storage devices, and LUN masks.

7. (Currently Amended) The process of claim 1, wherein a logical access path attribute further comprises an access path attribute selected from the group further consisting of bandwidth, component interoperability, proximity constraints, and type of component authentication.

8. (Original) The process of claim 1, and further comprising user-defined grouping of at least two logical access paths that share at least one of the logical path attribute value or are within a range of predefined logical path attribute values.

9. (Original) The process of claim 1, wherein collecting configuration information includes polling a SAN device API, simulating a CLI session with a SAN device, communicating with a SAN device using a CIM or SNMP protocol, or a combination thereof.

10. (Currently Amended) The process of claim 1, and further comprising validating a change state event of the SAN state by

collecting SAN event description information, and

processing the SAN event description information to identify SAN logical access paths that have access path attribute values that do not comply with the SAN access path policy, thereby indicating a changed state of the SAN state.

11. (Currently Amended) A process for validating a state change event of a storage area network (SAN), comprising the steps of:

defining a SAN access path policy representative of SAN logical access paths, said SAN logical access paths defining end-to-end access relationships between an application on a server, a sequence of one or more switches and physical links in the SAN, and data LUNs stored on storage devices in the SAN and having for the logical access paths an associated set of logical access path attributes consisting of at least one of a number of hops within a valid logical access path, a level of end-to-end redundancy for a valid logical access path, and a number of allocated ports for a valid logical access path, wherein the SAN access path policy includes a list of valid access paths and an associated set of access path attributes for the valid access paths.

defining a SAN state based on SAN logical access paths and attribute values associated with the logical access paths consisting of at least one of a number of hops within a valid logical access path, a level of end-to-end redundancy for a valid logical access path, and a number of allocated ports for a valid logical access path,

obtaining SAN event description information, and

comparing the SAN event description information with the SAN state to identify any logical path discrepancies or violations, thereby validating the state change event of the SAN.

12. (Original) The process of claim 11, and further defining a SAN change plan and comparing the SAN event description information with the SAN change plan.

13. (Original) The process of claim 11, wherein the SAN change event is selected from the group consisting of an erroneous change in a SAN device configuration, a planned change in a SAN device configuration and a device failure.

14. (Original) The process of claim 11, wherein the SAN event description is obtained by at least one of polling, trapping after an event occurs, by a direct administrator input, by an input from

a provisioning system about an intended change, by intercepting a change command before an event occurs.

15. (Currently Amended) A storage area network (SAN) validation manager, comprising:

a policy engine that stores a SAN access path policy representative of SAN logical access paths, said SAN logical access paths defining end-to-end access relationship between an application on a server, a sequence of one or more switches and physical links in the SAN, and data LUNs stored on storage devices in the SAN and having logical access path attributes with attribute values consisting of at least one of a number of hops within a valid logical access path, a level of end-to-end redundancy for a valid logical access path, and a number of allocated ports for a valid logical access path, wherein the SAN access path policy includes a list of valid access paths and an associated set of access path attributes for the valid access paths.

a validation engine that collects configuration information from devices of the SAN, standardizes formats of the configuration information and reconciles any conflicts, The the validation engine further processing the collected configuration information to identify the SAN logical access paths and computing the associated logical access path attribute values, and comparing the identified SAN logical access paths and computed logical access path attribute values with the list of valid access paths and associated set of access path attributes for the valid access paths in the SAN access path policy to identify any logical access path discrepancies or violations.

16. (Currently Amended) The SAN manager of claim 15, further comprising a change engine that collects SAN event description information, and processes the SAN event information to identify SAN logical access paths that have access path attribute values that do not comply with the SAN access path policy, thereby indicating a changed state of the SAN.

17. (Previously Presented) The process of claim 1, wherein processing the collected configuration information to identify the SAN logical access paths and computing the associated access path attribute values includes:

constructing a graph representation of the network topology such that each node in the graph represents a device, and each edge represents an information flow capability between two devices,

wherein the information flow capability is determined by analyzing a physical communication link between the two devices and logical configuration settings on the two devices.

18. (Currently Amended) The process of claim 17, wherein identifying the SAN logical access paths and computing the associated access path attribute values further includes:

analyzing the network topology of the constructed graph, wherein analyzing the topology comprises enumerating sequences of edges from nodes representing hosts to nodes representing data on storage devices, and

characterizing each node and each edge in terms of the logical configuration setting.

19. (Currently Amended) The process of claim 18, wherein determining the access path attributes further includes:

analyzing the identified sequences of edges in the constructed graph,

enumerating a plurality of distinct logical access paths leading from a first node representing a host to a second node representing data on a storage device, and

analyzing at least one of ~~the level of end-to-end redundancy~~, the number of hops, a level of end-to-end redundancy, and the number of allocated ports of each of the logical access paths, wherein the first node and the second node are different nodes.

20. (Previously Presented) The process of claim 11, wherein processing the collected configuration information to identify the SAN logical access paths and computing the associated access path attribute values includes:

constructing a graph representation of the network topology such that each node in the graph represents a device, and each edge represents an information flow capability between two devices, wherein the information flow capability is determined by analyzing a physical communication link between the two devices and logical configuration settings on the two devices.

21. (Currently Amended) The process of claim 20, wherein identifying the SAN logical access paths and computing the associated access path attribute values further includes:

analyzing the network topology of the constructed graph, wherein analyzing the topology comprises enumerating sequences of edges from nodes representing hosts to nodes representing data on storage devices, and

characterizing each node and each edge in terms of the logical configuration setting.

22. (Currently Amended) The process of claim 21, wherein determining the access path attributes further includes:

analyzing the identified sequences of edges in the constructed graph,

enumerating a plurality of distinct logical access paths leading from a first node representing a host to a second node representing data on a storage device, and

analyzing at least one of ~~the level of end-to-end redundancy~~, the number of hops, a level of end-to-end redundancy, and the number of allocated ports of each of the logical access paths, wherein the first node and the second node are different nodes.

23. (Previously Presented) The process of claim 15, wherein processing the collected configuration information to identify the SAN logical access paths and computing the associated access path attribute values includes:

constructing a graph representation of the network topology such that each node in the graph represents a device, and each edge represents an information flow capability between two devices, wherein the information flow capability is determined by analyzing a physical communication link between the two devices and logical configuration settings on the two devices.

24. (Currently Amended) The process of claim 23, wherein identifying the SAN logical access paths and computing the associated access path attribute values further includes:

analyzing the network topology of the constructed graph, wherein analyzing the topology comprises enumerating sequences of edges from nodes representing hosts to nodes representing data on storage devices, and

characterizing each node and each edge in terms of the logical configuration setting.

25. (Currently Amended) The process of claim 24, wherein determining the access path attributes further includes:

analyzing the identified sequences of edges in the constructed graph,

enumerating a plurality of distinct logical access paths leading from a first node representing a host to a second node representing data on a storage device, and

analyzing at least one of ~~the level of end-to-end redundancy~~, the number of hops, a level of end-to-end redundancy, and the number of allocated ports of each of the logical access paths, wherein the first node and the second node are different nodes.